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TRASK BRITT, P.C./ MICRON TECHNOLOGY
P.O. BOX 2550
SALT LAKE CITY, UT 84110

EXAMINER	
STARK, JARRETT J	

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/826,985
Filing Date: April 19, 2004
Appellant(s): LUO ET AL.

Brick G. Power
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 7/7/2008 appealing from the Office action mailed 1/28/2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

US 20030171456 A1	Tong, Quinn K. et al.	9-2003
US 6650019 B2	Glenn; Thomas P. et al.	2-2000

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-8 and 19-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tong et al. (US 2003/0171456).

Regarding claim 1, Tong discloses a method for forming a protective layer on a plurality of semiconductor device components, comprising:

providing a fabrication substrate carrying a plurality of semiconductor device components, adjacent semiconductor device components on the fabrication substrate

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being separated from one another by a street extending there between (Tong, ¶ [0013] –Inherently present before semiconductor chips or dies are separated/diced);

applying a protective material to active surfaces of at least the adjacent semiconductor device components (Tong, ¶ [0013] – B-stageable material – protective material that is semi-cured);

severing the protective material and at least partially severing the adjacent semiconductor device components from one another along the street (Tong, ¶ [0013] – Chips are dice after a being partially cured); and

subjecting at least the protective material to conditions (Tong, teaches the subjecting the structure to the same conditions) in which cracks and delaminated areas in the protective material that were formed during the at least partially severing are healed (Tong, ¶ [0013] – final complete curing – . If both are formed of the same material and same process of Applicant, then it naturally follows that any cracks formed in the soft b-stage material will undergo healing until the final curing process is complete. See previous response to arguments in the previously mailed Office Actions.), and

> In the preferred embodiment, the composition is B-stageable, i.e., the composition is capable of an initial solidification that produces a, smooth, non-tacky coating on the semiconductor wafer. The B-stage solidification preferably occurs in at a temperature in the range of about 100.degree. C. to about 150.degree. C. After the B-stage process, a smooth, non-tacky solid coating is obtained on the wafer to ensure the clean dicing of the wafer into individual chips. The final, complete curing occurs at a second temperature that is higher than the B-stage curing temperature. Generally, the final cure of the composition occurs after the formation of the interconnections. (Tong, ¶ [0013])

Tong discloses fully curing the protective material after cracks and delaminated areas are healed. However does not explicitly disclose and (fully curing) before assembling a semiconductor device components of the adjacent semiconductor device components to another component of an electrical device.

Paragraph [0013] of Tong merely teaches that the final curing takes place after dicing and after the formation of the interconnects. In the instant example described in the paragraph, the final curing temperature is the same as the melting temperature of the solder which is used to bond the interconnects. Thus, in the example Tong solder bonds the structure at the same time as the final curing. It is obvious that the two structures must first be assembled (bring interconnects together to be bonded) before melting the solder which bonds the interconnects.

Regardless, it would however be obvious to one of ordinary skill in the art of perform the final cure before or after any assembly step.

Ex parte Rubin , 128 USPQ 440 (Bd. App. 1959) (Prior art reference disclosing a process of making a laminated sheet wherein a base sheet is first coated with a metallic film and thereafter impregnated with a thermosetting material was held to render prima facie obvious claims directed to a process of making a laminated sheet by reversing the order of the prior art process steps.). See also In re Burhans, 154 F.2d 690, 69 USPQ 330 (CCPA 1946) (selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); In re Gibson, 39 F.2d 975, 5 USPQ 230 (CCPA 1930) (Selection of any order of mixing ingredients is prima facie obvious.).

When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. KSR Int'l Co v. Teleflex Inc.

Regarding claim 2, Tong discloses the method of claim 1, wherein providing comprises providing a fabrication substrate with at least one bond pad exposed at an active surface of each of the adjacent semiconductor device components (Tong, ¶ [0013]).

Regarding claim 3, Tong discloses the method of claim 2, wherein providing comprises providing a fabrication substrate with a plurality of semiconductor device components comprising at least one of semiconductor devices, interposers, and carrier substrates.

Regarding claim 4, Tong discloses the method of claim 2, wherein applying comprises applying the protective material such that the at least one bond pad of each of the plurality of semiconductor device components is exposed through the protective material sufficiently to effect electrical contact therewith (Tong, ¶ [0013]).

Regarding claim 5, Tong discloses the method of claim 2, wherein providing comprises providing the fabrication substrate with each of the plurality of semiconductor device components having a conductive structure protruding from the at least one bond pad thereof (Tong, ¶ [0013]).

Regarding claim 6, Tong discloses the method of claim 5, wherein applying comprises applying the protective material such that the protective material contacts a base portion of at least one conductive structure (Tong, ¶ [0013]).

Regarding claim 7, Tong discloses the method of claim 6, wherein applying comprises forming a support structure around the base portion of the at least one conductive structure (Tong, ¶ [0013]).

Regarding claim 8, Tong discloses the method of claim 5, wherein applying comprises applying the protective material such that the protective material is spaced apart from a base portion of at least one conductive structure (Tong, ¶ [0013]).

Regarding claim 19, Tong discloses the method of claim 1, wherein applying comprises applying the protective material in a liquid state (Tong, ¶ [0013]).

Regarding claim 20, Tong discloses the method of claim 19, further comprising spreading the protective material to form a protective layer on the active surfaces (Tong, ¶ [0013]).

Regarding claim 21, Tong discloses the method of claim 20, wherein applying the protective material in the liquid state comprises applying a quantity of a substantially uncured polymer to the active surfaces (Tong, ¶ [0013]).

Regarding claim 22, Tong discloses the method of claim 21, further comprising partially curing the polymer prior to severing and at least partially severing (Tong, ¶ [0013]).

Regarding claim 23, Tong discloses the method of claim 22, wherein healing is effected whiled the polymer remains in a partially cured state (Tong, ¶ [0013]).

Regarding claim 24, Tong discloses the method of claim 23, further comprising further curing the polymer after subjecting at least the protective material to conditions in which cracks and delaminated areas in the protective material that were formed during the at least partially severing are healed (Tong, ¶ [0013]).

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Regarding claim 25, Tong discloses the method of claim 24, further comprising completely severing the adjacent semiconductor device components from one another along the street following after fully curing the protective material (Tong, ¶ [0013]).

Regarding claim 26, Tong discloses the method of claim 20, wherein applying the protective material in the liquid state comprises applying liquefied thermoplastic material to the active surfaces (Tong, ¶ [0013]).

Regarding claim 27, Tong discloses the method of claim 26, further comprising permitting or causing the thermoplastic material to at least partially harden prior to severing and at least partially severing (Tong, ¶ [0013]).

Regarding claim 28, Tong discloses the method of claim 26, wherein healing comprises heating at least portions of the thermoplastic material located over peripheral regions of the adjacent semiconductor device components following severing and at least partially severing (Tong, ¶ [0013]).

Regarding claim 29, Tong discloses the method of claim 27, further comprising completely severing the adjacent semiconductor device components from one another along the street after subjecting at least the protective material to conditions in which cracks and delaminated areas in the protective material that were formed during the at least partially severing are healed (Tong, ¶ [0013]).

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Claims 9- 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tong et al. (US 2003/0171456) as applied to claims 1-8 above, and further in view of Glen et al. (US 6,650,019 A1).

Regarding claim 9, Tong discloses the method of claim 1, however does not explicitly disclose wherein applying comprises applying a preformed sheet of protective material to the active surfaces (Tong, ¶ [0013]).

Glen et al. discloses at the time of the invention it was known in the art that the B-stageable material can be applied as preformed sheets (Glen, Col. 8 lines 36-58).

It would have been within the scope of one of ordinary skill in the art at the time of the invention to combine the teachings of Tong and Glen to enable the applying the B-stage material step of Tong to be performed according to the teachings of Glen because one of ordinary skill would have been motivated to look to alternative suitable methods of performing the disclosed application step of Tong and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

> The spacer 50 can be made from a variety of materials, including a fiberglass matrix impregnated with a tacky, uncured (i.e., "B-stage") epoxy resin, or a ceramic, silicon or an oxide thereof, or alternatively, a plastic polymer sheet cut to the appropriate size. The adhesive layers 52 and 54 can be applied to the spacer 50 before it is attached to the first die 14, or alternatively, can be applied sequentially at the time the spacer is mounted to the die, first to the top surface of the first die 14, then to the top surface of the spacer before the second die is mounted on top of it. In yet another variation, the adhesive layer 54 used to mount the second die 16 on the spacer 50 can comprise the same adhesive material as the bead of uncured, fluid adhesive 40 dispensed around the perimeter 17 of the spacer 50, and can be deposited simultaneously therewith. In all cases, the layers of adhesive 52 and 54 on the spacer 50, and the layer 42 of adhesive 40 may all be simultaneously cured in a single step. (Glen, Col. 8 lines 36-58)

Regarding claim 10, Tong in view of Glen discloses the method of claim 9, wherein applying the preformed sheet comprises applying a preformed sheet comprising partially cured protective material (Glen, Col. 8 lines 36-58).

Regarding claim 11, Tong in view of Glen method of claim 9, wherein applying the preformed sheet comprises applying a preformed sheet comprising thermoplastic material.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a thermoplastic material since it has been held to be within the general skill of a worker in the art to select a known material on the base of its suitability, for its intended use involves only ordinary skill in the art. *In re Leshin*, 125 USPQ 416.

Regarding claim 12, Tong in view of Glen method of claim 9, wherein applying preformed sheet comprises applying a preformed sheet including apertures positioned to align with the at least one bond pad of each of the adjacent semiconductor device components (Tong, ¶ [0013]).

Regarding claim 13, Tong in view of Glen method of claim 2, wherein applying comprises applying a preformed sheet of protective material to the active surfaces (Glen, Col. 8 lines 36-58).

Regarding claim 14, Tong in view of Glen method of claim 13, wherein applying the preformed sheet comprises applying a preformed sheet comprising partially cured protective material (Glen, Col. 8 lines 36-58).

Regarding claim 15, Tong in view of Glen method of claim 13, wherein applying the preformed sheet comprises applying a preformed sheet comprising thermoplastic material.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a thermoplastic material since it has been held to be within the general skill of a worker in the art to select a known material on the base of its suitability, for its intended use involves only ordinary skill in the art. *In re Leshin*, 125 USPQ 416.

Regarding claim 16, Tong in view of Glen method of claim 13, wherein applying the preformed sheet comprises applying a preformed sheet including apertures therein positioned to align with the at least one bond pad of each of the adjacent semiconductor device components (Tong, ¶ [0013]).

Regarding claim 17, Tong in view of Glen method of claim 13, wherein applying the preformed sheet comprises applying the preformed sheet such that a conductive structure protruding from each of the adjacent semiconductor device components on the fabrication substrate passes through a plane of the preformed sheet (Tong, ¶ [0013]).

Regarding claim 18, Tong in view of Glen method of claim 17, further comprising heating each conductive structure prior to applying the preformed sheet (Tong, ¶ [0006]).

(10) Response to Argument

Regarding arguments directed to claim 1:

Appellants argue that the reference Tong does not teach the step of subjecting the material to “conditions” in which cracks and delaminated areas in the material will be healed.

In response it is first noted that the Appellant’s specification does not specifically disclose what the "conditions" are, therefore “conditions” is left open to the broad interpretation of any condition.

The cited prior art reference teaches the same claimed process steps under "conditions" using the same material as disclosed in the Appellant’s specification. It is obvious to one of ordinary skill in the art and naturally follows that the prior art process being performed upon the same material under “conditions” is capable of the claimed "self-healing" results.

As conventionally understood in the art and presented in the prosecution history supra, a B-staged material is a highly viscous material which maintains the ability to flow

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(slowly) after the first partial curing step. There is an inherent finite amount of time between the first curing step and the second curing step which fully cures the material into its final hardened from. This finite amount of time can be an ambient "condition" in which healing is capable of occurring. Since the material has the ability to flow during this time, the material has the capability to self heal any cracks or delaminations that might have occurred during the dicing.

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Regarding arguments directed to claims 2-8, 19-23, and 25-29:

Each of claims 2-8, 19-23, and 25-29 is argue as allowable for depending either directly or indirectly from claim 1. Claim 1 is not allowable for the reasons presented supra, thus this argument is moot.

Regarding arguments directed to claim 8:

Regarding the argument that Tong does not teach the claim structure, Structural Elements recited in the claim must manipulatively distinguish the claim from the prior art to have patentable weight. To be entitled to patentable weight in method claims, the recited structural limitations therein must affect the method in a manipulative sense and not amount to mere claiming of a use of a particular structure.

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Never the less, giving the structure patentable weight Tong still discloses the limitation (see Tong paragraph [0004]. In the instant case the implied steps claim applying the material to the surface of the substrate that includes conductive structures. Tong explicitly teaches the protective materials can be applied as an underfill to add additional support for interconnects of a flip chip. Thus the material surrounds the interconnects and is "spaced apart from a base portion of the least one conductive structure."

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Regarding arguments directed to claim 25:

Tong paragraph [0013] implicitly discloses "singulating semiconductor devices from a fabrication substrate once the material of a protective layer on the semiconductor devices has been singulated, then fully cured." Tong states the dicing (dicing is synonymous with the term singulating) occurs while the protective material is in it's B-stage (meaning prior to final curing step).

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Regarding arguments directed to claim 28:

In response to appellant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "healing the protective material by heating") are not recited in the rejected claim(s). Additionally, the Appellant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "healing the protective material by heating") are not recited in the specification and will constitute new matter.

Regarding arguments directed to claim 9-18:

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in

the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the reference Glenn is only applied to show it was known at the time of the invention B-stageable material can be applied by "applying a preformed sheet comprising partially cured protective material."

An example of a apparent reason one of ordinary skill in the art would select a known method of applying a known material would be: *When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.* KSR Int'l Co v. Teleflex Inc.

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(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

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For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Jarrett J Stark/
Examiner, Art Unit 2823

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Conferees:

/Jarrett J Stark/
Examiner, Art Unit 2823

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/Matthew S. Smith/
Supervisory Patent Examiner, Art Unit 2823

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Drew A. Dunn
/D. A. D./
TQAS, TC 2800

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